S'COOL BREEZE

Student's Cloud Observations On-Line

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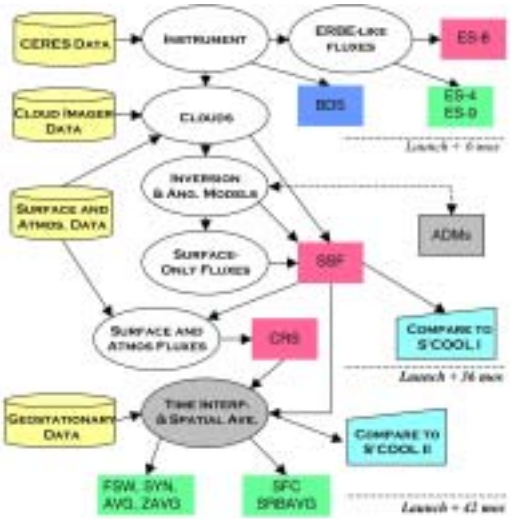
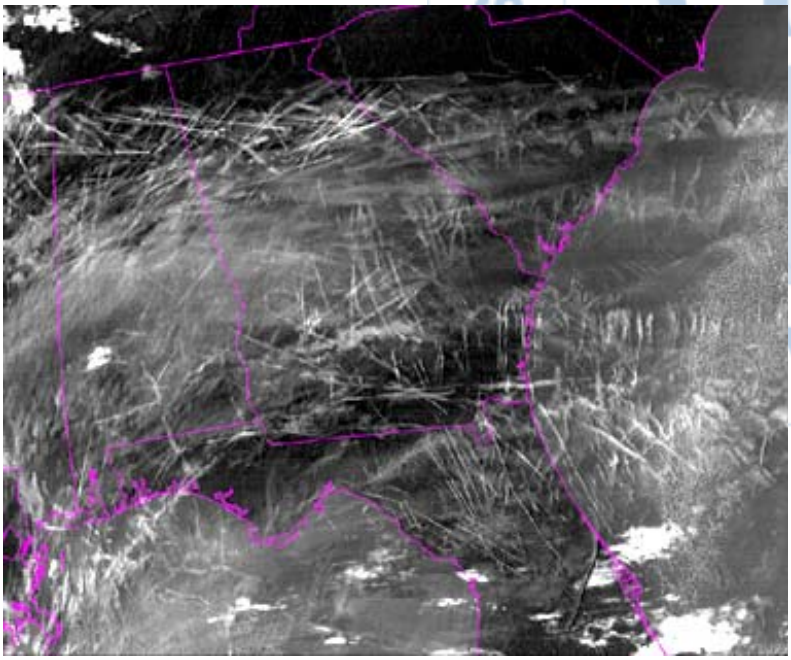
New Geostationary Observing Times

By Dr. Lin H. Chambers, NASA Langley Research Center

Two needs have recently converged to provide new observation time options for S'COOL participants. First, many teachers have reported that their biggest challenge in implementing S'COOL in the classroom is dealing with the changing overpass times for the Terra and Aqua spacecraft. Second, the CERES team has begun concentrating on data products obtained using geostationary (geo) satellites that take the CERES data a step further (see shaded oval in figure). The Time Interpolation & Spatial Averaging (TISA) products correct the once-a-day CERES measurement to represent the entire 24-hour period. This produces a second opportunity to use student data for ground truth validation at geostationary observing times. *(Continued on page 2)*



Contrails May Account for Warming Trend



This enhanced infrared image from NASA's Terra satellite shows a widespread outbreak of contrails over the southeastern United States on the morning of Jan. 29. The criss-crossing white lines are contrails that form from planes flying in different directions at different altitudes.

By Julia Cole, SAIC-Langley Research Center

NASA scientists have found that cirrus clouds formed by contrails from aircraft engine exhaust are capable of increasing average surface temperatures enough to account for a warming trend in the United States that occurred between 1975 and 1994.

"This result shows the increased cirrus coverage, attributable to air traffic, could account for nearly all of the warming observed over the United States for nearly 20 years starting in 1975, but it is important to acknowledge contrails would add to and not replace any greenhouse gas effect," said Patrick Minnis, senior research scientist at Langley Research Center.

The study was published in the April 15 edition of the Journal of Climate.

"During the same period, warming occurred in many other areas where cirrus coverage decreased or remained steady," Minnis said. "This study demonstrates that human activity has a visible and significant impact on cloud cover and on climate. It indicates that contrails should be included in climate change scenarios."

Minnis determined the observed 1 percent per decade increase in cirrus cloud cover over the United States is

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likely due to air traffic-induced contrails. Using published results from NASA's Goddard Institute for Space Studies, Minnis and his colleagues estimated contrails and their resulting cirrus clouds would increase surface and lower atmospheric temperatures by 0.36 to 0.54 degrees Fahrenheit per decade. Weather service data reveal surface and lower atmospheric temperatures across North America rose by almost 0.5 degree Fahrenheit per decade between 1975 and 1994.

Minnis worked with colleagues Kirk Ayers, Rabi Palikonda and Dung Phan from Analytical Services and Materials, Inc. They used 25 years of global surface observations of cirrus clouds, temperature and humidity records from the National Centers for Environmental Prediction (NCEP) reanalysis dataset. They confirmed the cirrus trends with 13 years of satellite data from NASA's International Satellite Cloud Climatology Project.

A wonderful display of contrails at various stages of spreading is a fairly common sight along the east coast of the Unite States

Both air traffic and cirrus coverage increased during the period of warming despite no changes in the NCEP humidity at jet cruise altitudes over the United States. By contrast, humidity at flight altitudes decreased over other land areas, such as Asia, and was accompanied by less cirrus coverage, except over Western Europe, where air traffic is very heavy.

Cirrus coverage also rose in the north Pacific and north Atlantic flight corridors. The trends in cirrus cover and warming over the United States were greatest during winter and spring, the same seasons when contrails are most frequent. These results, along with findings from earlier studies, led to the conclusion that contrails caused the increase in cirrus clouds.

Persistent contrails spread into extensive cirrus clouds during New Mexico's Balloon Festival

"This study indicates that contrails already have substantial regional effects where air traffic is heavy, such as over the United States," Minnis said. "As air travel continues growing in other areas, the impact could become globally significant."

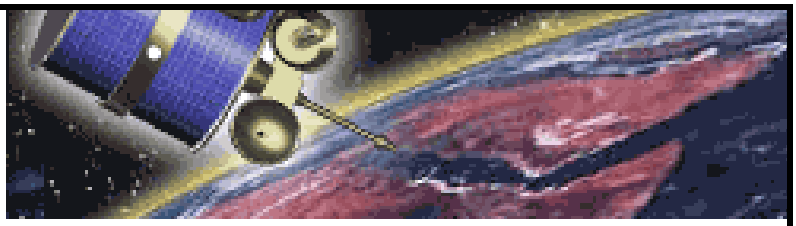
Humidity is the amount of water vapor in the air and determines how long contrails remain in the atmosphere. Contrails that persist for an extended period of time are most likely to impact the climate.

Contrails form high in the atmosphere when the mixture of water vapor in the aircraft exhaust and the air condenses and freezes. Persisting contrails can spread into extensive cirrus clouds that tend to warm the Earth, because they reflect less sunlight than the amount of heat they trap. The balance between Earth's incoming sunlight and outgoing heat drives climate change.

NASA's Earth Science Enterprise funded the research.

Continued from page 1 - New Geostationary Observing Times

While geo satellites scan the Earth as often as every 15 minutes (and are often used in your TV weather report), currently CERES uses only imagery taken every 3 hours. The schedule is slightly different for each geo satellite, so we have developed a clickable map (http://asd-www.larc.nasa.gov/SCOOL/sat_schedule.html) that will give you the 3-hourly geo times for your location. As with Terra and Aqua, we ask for observations within +/- 15 minutes of the image time. This should provide you with 3-4 additional options for observation times during the school day – but these times will stay constant for months at a time (changes occur when geo satellites are replaced, so please check the clickable map every few months). Observations at geo times should use the new "Geo satellite" option on the on-line report form.



Meteosat 5 overlooking areas near the Arabian Sea and Saudi Arabia.

Photograph of Meteosat spacecraft

For a more detailed explanation of the chart found on page 1 please visit our S'COOL website at: http://asd-www.larc.nasa.gov/SCOOL/geo_announce.html

GOES captured this image of clouds over the Puerto Rico region on September 17, 2002.

Quarters Worth of Websites

Contrail Education: http://asd-www.larc.nasa.gov/GLOBE/

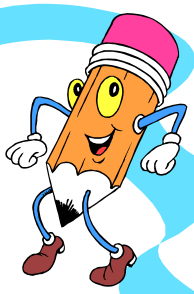
What are contrails? How are contrails different from other clouds? Are there different types of contrails? What type of contrail is most interesting to scientists? Why is it important ot study contrails? How can students help scientist study contrails? You can find the answers to these and many more questions at the most complete contrail website supported by NASA researchers. Try downloading the Contrail ID chart and help researchers find answers to this new field of climate study by allowing your students to participate as 'contrail observers.'

Take a Nostalgic Look at **Previous S'COOL Breeze Headlines: http://asd-www.larc.nasa.gov/SCOOL/breeze/**

Take a nostalgic journey through the S'COOL headlines and experience the transformation undertaken by the S'COOL project over the last 7 years. Enjoy great articles by some of NASA's leading scientists/researchers on topics such as the importance of studying clouds, the CERES instrument, satellite launches, evolution of contrail science, the bridge between NASA research and the classroom, great lesson ideas and classroom resources, and many more topics.

S'COOL's Top 25 Observers

The database continues to grow as students continue to head OUT to observe and send their data IN. "Thank you" to all participating schools that have contributed to this effort by submitting observations. We would like to recognize this year's top 25 schools with the greatest number of reported observations between the months of June 2003 and May 2004.



This Year's Top 25 S'COOL Observing Schools are:

1. Chartiers-Houston Jr/Sr High School, Houston, PA, USA
2. Osnovna Skola Mate Lovraka, Veliki Grdjevac, Croatia
3. Americano Nicaraguense, Managua, Nicaragua
4. Colegio de Desarrollo Rural Miguel Valen, Antioquia, Columbia
5. Escuela Industrial No. 6, Santa Cruz, Argentina
6. Harding Middle School, Cedar Rapids, IA, USA
7. St. Anne's School, Porterville, CA, USA
8. Eugenio Maria de Hostos, Mayaguez, Puerto Rico
9. Tied: Ecole Primaire Publique, Etrun, France
   Colegio Radians, Cayey, Puerto Rico
10. Escuela: 18 - DE: 21, Buenos Aires, Argentina
11. St. James School, Falls Church, VA, USA
12. Kadoka School District, Kadoka, SD, USA
13. Shenandoah Middle School, Shenandoah, IA, USA
14. Jewett Street School, Manchester, NH, USA
15. Emmaus Christian School, Maenza, Italy
16. Waynesboro Area High School, Waynesboro, PA, USA
17. YEMST, Yorktown, VA, USA
18. Waiau Elementary School, Pearl City, HI, USA
19. North Ridge Magnet School, Moreno Valley, CA, USA
20. Columbia Middle School, Logansport, IN, USA
21. Istituto Comprensivo Gianni Rodari, Vermezzo (MI), Italy
22. Redmond Elementary, Redmond, WA, USA
23. Sissonville Elementary School, Sissonville, WV, USA
24. Hunterdon Christian Academy, Flemington, NJ, USA
25. Cumberland High School, Cumberland, VA, USA

NASA STEMS

NASA Science **T**rivia to **E**xcite & **M**otivate **S**tudents

You are probably aware that weather geostationary satellites can provide global coverage 24 hours a day but did you know that the first weather satellite was launched in April of 1960? It's name was **TIROS 1** (**T**elevision and **I**nfrared **O**bservation **S**atellite) and it was launched with TV cameras and transmitters on board. Pictures could only be taken for 6 hours a day since, due to its rotation, it was pointed away from the Earth 75% of the time. It lasted for only 79 days.

Teacher Corner

Over 1700 participants are now registered.

Keep spreading the word!

Have you changed your school information or will you be moving to another school?

Please remember to notify us of any changes in your school information, e-mail address or anything you feel is important for our database. A special 'Thank You!' to those of you who have written with current information.

Thank you for your continued participation!

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Upcoming Events

Living With A Star Conference
July 6-9, 2004
Anchorage, AK, USA

IOP—Intensive Observation Period
July 19-23. 2004
World-wide

GLOBE Meeting
July 25-30, 2004
Boulder, CO USA

http://asd-www.larc.nasa.gov/SCOOL/visits.html

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Dr. Lin Chambers, French translator
Roberto Sepulveda, Spanish translator

A Colombian S'COOL Connection!

"The students have responded well and remain motivated. We have about five students interested in continuing in the study of meteorology. We are also happy because the project has allowed us to integrate all subjects at our school and collaborate with other institutions in the nearby communities."

Mercedes Arrubla, Colegio de Desarrollo Rural Miguel Valen; Jardin, Antiquia, Colombia